

REMARKS

This is intended as a full and complete response to the Office Action dated September 3, 2003, having a shortened statutory period for response extended three months to expire on March 3, 2004. Claims 1-15, 17, and 19-44 remain pending in the application and are shown above. Claims 1-15, 17, and 19-44 are rejected by the Examiner. Reconsideration of the rejected claims is requested for reasons presented below.

Claims 1-9 stand rejected under 35 U.S.C. § 102(b) as being anticipated by *Leuschner et al.* (U.S. Patent No. 6,042,993). The Examiner asserts that *Leuschner et al.* discloses the subject matter recited in claim 1-9. Applicants respectfully respond to this rejection.

Leuschner et al. discloses a bilayer resist with the top resist formed of an electron beam-sensitive silicon-containing resist which is structured by scanning tunneling microscopy (STM) or scanning force microscopy (SFM) with electrons.

Thus, *Leuschner et al.* does not teach, show or suggest depositing an amorphous carbon layer on a substrate, depositing a silicon containing photoresist layer on top of the amorphous carbon layer, developing a pattern transferred into the resist layer with an ultraviolet radiation photolithographic process, and forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in at least one region defined by the pattern in the resist layer, as recited in claim 1 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 10, 11, 17, 19-32, 36, 37, and 42-44 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Leuschner et al.* in view of *Mitani et al.*, (U.S. Patent No. 6,191,463). The Examiner asserts that it would have been obvious to one of ordinary skill in the art to prepare the material of *Leuschner et al.* and adding the insulating layer of silicon oxide or silicon nitride as taught by *Mitani et al.* Applicants respectfully respond to this rejection.

Leuschner et al. is described above. *Mitani et al.* discloses an apparatus and method for forming an improved insulating film on a substrate using a CVD process to deposit a thermally insulating film, a silicon oxide layer from a halogen element and any

one of a combination of silicon and nitrogen and a combination of silicon, oxygen and nitrogen. *Mitani* does not suggest or motivate depositing a silicon containing photoresist on an amorphous carbon layer or forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in a patterned region defined by the resist pattern.

Thus, the combination of *Leuschner et al.* and *Mitani et al.* does not teach, show, or suggest depositing an amorphous carbon layer on a substrate, depositing a silicon containing photoresist layer on top of the amorphous carbon layer, developing a pattern transferred into the resist layer with an ultraviolet radiation photolithographic process, and forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in at least one region defined by the pattern in the resist layer, and further comprising forming a material layer on the substrate with a chemical vapor deposition process prior to forming the amorphous carbon layer, as recited in claim 10 and claim 11 dependent thereon. Withdrawal of the rejection is respectfully requested.

Further, the combination of *Leuschner et al.* and *Mitani et al.* does not teach, show, or suggest depositing an amorphous carbon layer on the material layer, depositing a photoresist layer on top of the amorphous carbon layer, developing a resist pattern transferred into the photoresist layer with an ultraviolet radiation photolithographic process, forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in a patterned region defined by the resist pattern, and etching through the material layer under the amorphous carbon layer using the patterned region etched into the amorphous carbon layer and the resist pattern, as recited in claim 17, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 36-44 have been cancelled without prejudice and Applicants respectfully request withdrawal of the rejection as to claims 36, 37, and 42-44.

Claims 12-14 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Leuschner et al.*, in view of *Lin et al.*, U.S. Patent No. 6,087,064. The Examiner asserts that it would have been obvious to one of ordinary skill in the art to prepare the material of *Leuschner et al.* using the silicon containing resist of *Lin et al.* Applicants respectfully respond to this rejection.

Leuschner et al. is described above. *Lin et al.* discloses a process for forming silsequioxane polymers for use in negative photoresist compositions and photolithographic processes. The lithographic method of *Lin* is generally described as using a photoresist compound that includes a silicon containing polymer component, an acid-sensitive crosslinking component, and a photosensitive acid generator. (See Column 7, Lines 58 – 65) The silicon containing polymer component portion of the photoresist is described as having a silicon content of at least about 5 wt. %, and more preferably at least about 10 wt. %. (See Column 10, Lines 24 – 35). *Lin* does not suggest or motivate depositing a silicon containing photoresist on an amorphous carbon layer or forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in a patterned region defined by the resist pattern.

Thus, the combination of *Leuschner et al.* and *Lin et al.* does not teach, show, or suggest depositing an amorphous carbon layer on a substrate, depositing a silicon containing photoresist layer on top of the amorphous carbon layer, developing a pattern transferred into the resist layer with an ultraviolet radiation photolithographic process, and forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in at least one region defined by the pattern in the resist layer, and further comprising forming a material layer on the substrate with a chemical vapor deposition process prior to forming the amorphous carbon layer, as recited in claim 1 and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 33-35 and 38-41 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Leuschner et al.*, in view of *Lin et al.* and *Mitani et al.* The Examiner asserts that it would have been obvious to one of ordinary skill in the art to prepare the material of *Leuschner et al.* using the silicon containing resist of *Lin et al.* and adding the insulating layer of silicon oxide or silicon nitride as taught by *Mitani et al.* Applicants respectfully respond to this rejection.

Leuschner et al., *Mitani et al.*, and *Lin et al.* are described above.

The combination of *Leuschner et al.*, *Mitani et al.*, and *Lin et al.* does not teach, show, or suggest depositing an amorphous carbon layer on the material layer,

depositing a photoresist layer on top of the amorphous carbon layer, developing a resist pattern transferred into the photoresist layer with an ultraviolet radiation photolithographic process, forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in a patterned region defined by the resist pattern, and etching through the material layer under the amorphous carbon layer using the patterned region etched into the amorphous carbon layer and the resist pattern, as recited in claim 17, and claims dependent thereon. Withdrawal of the rejection is respectfully requested.

Claims 36-44 have been cancelled without prejudice and Applicants respectfully request withdrawal of the rejection as to claims 38-41.

Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Leuschner et al.*, in view of *Sobczak* (U.S. Patent No. 4,576,834). The Examiner asserts that it would have been obvious to one of ordinary skill in the art to prepare the material of *Leuschner et al.* with the etching process as taught by *Sobczak*. Applicants respectfully respond to this rejection.

Leuschner et al. is described above. *Sobczak* discloses a semiconductor stack fabrication process wherein an RIE process is used to etch an underlying layer masked by a photoresist layer. The RIE process is disclosed as etching the underlying layer while also removing a portion of the photoresist layer. *Sobczak* does not suggest or motivate depositing a silicon containing photoresist on an amorphous carbon layer or forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in a patterned region defined by the resist pattern.

Thus, the combination of *Leuschner et al.* and *Sobczak* does not teach, show, or suggest depositing an amorphous carbon layer on a substrate, depositing a silicon containing photoresist layer on top of the amorphous carbon layer, developing a pattern transferred into the resist layer with an ultraviolet radiation photolithographic process, and forming an in situ resist layer hard mask in an outer portion of the photoresist layer while etching through the amorphous carbon layer in at least one region defined by the pattern in the resist layer, wherein the silicon containing photoresist layer, the amorphous carbon layer, and the resist layer hard mask may be removed by a single



etching process selective to these layers and leaving an underlying layer on the substrate, as recited in claim 15. Withdrawal of the rejection is respectfully requested.

The secondary references made of record are noted. However, it is believed that the secondary references are no more pertinent to the Applicant's disclosure than the primary references cited in the office action. Therefore, Applicant believes that a detailed discussion of the secondary references is not necessary for a full and complete response to this office action.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed. Having addressed all issues set out in the office action, Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,

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